

attached to the pedicel) was also slightly indented, so that in outline it presented a guitar-shaped figure, each rounded half of which bore a pair of unequal cilia, and contained a contractile vesicle. In one minute more the contraction had increased to such an extent that the body was divided about halfway through. By 2.54 P.M. the animal had a dumb-bell shape, and the pedicel was attached to one of the segments near the point of constriction. Still the process went on very rapidly, and by 2.55 P.M. the new bodies were widely separated, but still attached to each other by a mere thread. At 3 P.M. the body which was attached to the pedicel was left alone, and its companion swam away to seek a new attachment and build up its stem.

To the last moment the hyaline envelope remained about the segments, and in fact so long afterwards that time and circumstances did not allow me to ascertain its final disposition. I would remark, however, that when the ovate bodies of the half-grown monads are contracted temporarily into a globular shape, they appear identical (excepting that they lack the hyaline envelope) with these recently fissated forms. In all probability, therefore, the latter lose their envelope and assume the shape of the former.

As to the development of the stem, I think it quite certain that it grows out from the posterior end of the body. The best proof of this is, that I have frequently found a monad (especially in the condition of the one which I described above as breaking loose from its companion) nearly sessile upon a clean spot, and attached by a very short, faint, film-like thread. From this size upward I had no difficulty in finding abundant examples as gradually increasing in diameter as they did in length—thus furnishing a pretty strong evidence that the stem grows under the influence of its own innate powers, and is not, therefore, a deposit emanating from the body of the monad, except, perhaps, as far as it may be nourished by a fluid circulating within its hollow core.

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LVI.—*On Two European Argulidæ, with Remarks on the Morphology of the Argulidæ and their Systematic Position, together with a Review of the Species of the Family at present known.* By T. THORELL.

[Concluded from p. 286.]

#### IV.

I SHALL now pass in review the species of Argulidæ hitherto known, although many of them are so incompletely described that it is not without difficulty that they can be determined.

The arrangement which I have adopted can therefore be only provisional, and is put forward merely with a view to draw attention, on the part of those who have opportunities for examining new or incompletely known Argulidæ, to the characters which have seemed to me the most important for the systematic arrangement of these animals. Excepting in the case of the three European species, which I have had occasion to examine myself, the diagnoses are compiled from the descriptions and figures of others. I shall first range the fifteen (or sixteen) known Argulids in the order which seems to me the most natural, and then briefly particularize each species separately.

### BRANCHIUURA.

Corpus depressum, capite in scutum magnum, postice plerumque bifidum dilatato; oculi compositi longe sejuncti. Antennæ breves; primi paris unco incurvo armatæ, cum maxillipedibus primi paris ad figendum aptæ; secundi paris simplices, articulis paucis (4-5). Os in siphonem productum, mandibulas et, si quæ adsunt, maxillas quoque includentem; maxillipedes fortissimi, anteriores plerumque cotyledones formantes. Truncus segmentis 4, distinctis; pedum paria 4, natatoriorum, biramium, appendicibus branchialibus carentium. Cauda non segmentata, plana, foliacea, respirationi inserviens, testes aut receptacula seminis includens. Metamorphosis incompleta.

Animalia in cute externa, in cavitate branchiali vel in branchiis piscium (et batrachiorum) parasitantia.

Fam. ARGULIDÆ, Leach, cet. (*Argulina*, Kr., Burm., cet.). Character subordinis etiam familiæ unicæ.

#### Gen. I. ARGULUS, Müller (1785).

*Monoculus*, Linn., cet.; *Binoculus*, Geoffr., cet.; *Ozolus*, Latr.; *Agenor*, Risso.

Maxillipedes primi paris in adultis cotyledones formantes.

α. Pedes flagello carent. Stimulus ante siphonem adest. Siphonem mandibulas et maxillas continet. (*Agenor*, Risso.)

1. *A. purpureus* (Risso).

? 2. *A. giganteus*, Lucas.

β. Pedes parium 1<sup>m</sup> et 2<sup>d</sup> flagello instructi. Stimulus adest. Siphonem mandibulas et maxillas continet. (*Argulus*, Müll.)

3. *A. foliaceus* (Linn.).

4. *A. coregoni*, Thor.

? 5. *A. pugettensis*, Dana.

6. *A. catostomi*, Dana et Herr.

γ. Pedes parium 1<sup>mi</sup> et 2<sup>di</sup> flagello instructi. Stimulus adest.  
Sipho mandibulas tantum includit. (*Camulus\**, nob.)

7. *A. Nattereri*, HELL.

δ. Pedes parium 1<sup>mi</sup> et 2<sup>di</sup> flagello instructi. Stimulus nullus?  
Sipho?

8. *A. salmini*, KR.

9. *A. chromidis*, KR.

10. *A. funduli*, KR.

? 11. *A. alosæ*, GOULD.

? 12. *A. elongatus*, HELL.

## Gen. II. GYROPELTIS, Heller (1857).

Maxillipedes primi paris apice unco forti armati (cotyledonibus nullis). Pedes parium 1-3<sup>ti</sup> flagello instructi. Stimulus nullus. Sipho mandibulas tantum includit.

1. *G. longicauda*, HELL.

2. *G. doradis*, CORN.

3. *G. Kollari*, HELL.

[? 4. *G. Lacordairei* (AUD.)]

### I. ARGULUS, Müller.

1. *A. purpureus* (Risso).

See p. 158.

2. *A. giganteus*, Lucas.

SYN. *Argulus giganteus*, Lucas, Exploration scientifique de l'Algérie; Hist. Nat. d. Animaux Articulés, Première Partie: Crustacés, (1845) p. 83, pl. 8. fig. 9.

"*A. ovatus*, flavescens, subtiliter rubro punctatus; testa dilatissima, membranacea, utrinque fusco-rubescente unilineata. Long. 11 millim., latit. 7 millim."

*Hab.* in Mari Mediterraneo, ad oras Africae (Algeriae), in *Rajæ* sp. inventus.

I have been obliged to present the above diagnosis as Lucas has given it: it is certainly accompanied by a sort of description, but from this we get no further knowledge respecting the animal. The description, which is taken from a dried specimen, is so defective that; were it not that the author expressly says that he observed "de chaque côté de la base du bec, un appendice gros et court terminé par une ventouse cupuliforme," we should hardly be able to recognize the animal as belonging to the Argulidæ. "Il ne me reste," says he, "de ce crustacé curieux que le test. . . . Les antennes n'existent plus, et les organes de la

\* Nomen propr. mythol.

locomotion ainsi que l'abdomen étant en trop mauvais état pour que je puisse en décrire la forme, je n'en parlerai pas." By the word *bec* is probably meant the *sting*, not the mouth-tube. All further information respecting this animal is summed up as follows:—" Cette espèce est bien moins discoïdale que l'*A. foliaceus* . . . . Jaunâtre, la tête est grande, très-allongée, et paraît arrondie à ses parties antérieure et postérieure; elle est fortement sillonnée longitudinalement entre les yeux, et ceux-ci, qui sont noirs, affectent une forme discoïdale. Le test est très-dilaté, membraneux, transparent et paraît postérieurement ne pas être dépassé par l'abdomen; il est jaune, finement pointillé de rougeâtre, et parcouru longitudinalement, de chaque côté, par une ligne d'un brun rougeâtre."

Of more value than this description is the statement that the animal was procured " en mai sur une Raie qui avait été prise dans la rade d'Alger, entre le fort de l'Eau et le cap Matifou."

The figure gives no clearer idea of the characters of the animal than the description. I have placed it next to *A. purpureus* on the ground of the elongated form of the shield, and because, as would seem to be expressed above, it appears to stretch over and cover the tail, as in that species. Both occur, moreover, in the same sea.

### 3. *A. foliaceus* (Linn.).

SYN. *Monoculus foliaceus*, Linné, Syst. Nat. ed. 10, tom. i. (1758) p. 634.  
*Argulus Charon*, Müller, Entomostraca, (1785) p. 723, tab. 20. figg. 1, 2 (larva).

— *delphinus*, id. ibid. p. 123.

— *foliaceus*, Jurine, Ann. du Mus. d'Hist. Nat. tome vii. (1806) p. 431, pl. 26. figg. 1-21; Milne-Edwards, Hist. Nat. d. Crustacés, iii. p. 444; Baird, British Entomostraca, p. 255, pl. 31. figg. 1, 2 a-l.

Scutum cephalicum subovatum, antice utrinque parum sinuatum, pedes omnes, ultimi paris exceptis, tegens; cauda ovata, longitudine circa  $\frac{1}{4}$  reliqui corporis, vix usque ad medium incisa, laciniis apice rotundatis; stimulus longus; siphon subclavatus; art. primus antennarum secundi paris aculeo valido armatus; cotyledones parvi, diametro circiter  $\frac{1}{9}$  corporis longitudinis æquantes; pecten plaga media oblongo-rotundata scabra, dentibusque 3 fortibus acutis; alii dentes 2 inter maxillipedes secundi paris adsunt.—Longit. 6-7 millim., latit. circa  $3\frac{1}{2}$  millim. (♂ ♀).

*Hab.* in aquis dulcibus fere totius Europæ, in cute externa et in cavitate branchiali (?) piscium (*Gasterosteorum*, *Cyprini carpionis*, *Abramis brama*\*, *Leucisci rutili*, *Tinca vulgaris*, *Esocis lucii*, *Perce fluviatilis*, *Salmonis trutta*), et in larvis *Ranarum* parasitans.

For a more complete synonymy we would refer to the works

\* According to Mag. Widegren.

of Milne-Edwards and Baird above cited. It is not impossible that, under the appellation *A. foliaceus*, two separate species have been confounded. The figures which Vogt\* has given of this animal differ from the Swedish (and consequently from the genuine) form in having the tail much smaller and almost bent inwards laterally. Jurine and Baird represent the tail such as I have found it in my own specimens.

4. *A. coregoni*, Thor.

See page 162.

5. *A. pugettensis*, Dana.

SYN. *Argulus pugettensis*, Dana, United States' Exploring Expedition, Crustacea, (1853) ii. p. 1351, pl. 94. figg. 2 a et b.

Scutum cephalicum oblongum, ellipticum, pedes omnes tegens; cauda magna, oblonga, longitudine circa  $\frac{2}{3}$  reliqui corporis, et latitudine  $\frac{2}{3}$  latit. scuti fere æquans, usque ad medium incisa, laciniis subacuminatis; stimulus longus; siphon subclavatus; cotyledones sat magni, diametro  $\frac{1}{6}$ — $\frac{1}{7}$  corporis longitudinis æquantes; pectinis dentes 3 subconici; dentes 2 inter maxillipedes secundi paris adsunt.—Long. circa 17, latit. 10 millim. (♀?).

Hab. in America boreali (ad oras occid.: "Puget's Sound"). Hospitium ignotum.

This very scanty description contains nothing respecting the oral organs; but the accompanying figures, which seem to be good, and which present the animal both from the dorsal and ventral aspects, show so strong a likeness to the two species immediately preceding, that I have not hesitated to place it in the same subdivision of the genus with them. The tail is proportionally larger, and especially broader at the base, than in *A. coregoni*.

6. *A. catostomi*, Dana et Herr.

SYN. *Argulus catostomi*, Dana et Herrick, Silliman's Amer. Journ. (1837) xxxi. p. 297. figg. 1-11; Milne-Edwards, Hist. Nat. d. Crustacés, iii. p. 445.

Scutum cephalicum amplum, suborbiculatum, paullo latius quam longius, antice utrinque subsinuatam, pedes quoque ultimi paris ad partem tegens; cauda lata, rotundata, longitudine circa  $\frac{1}{4}$  reliqui corporis, postice non usque ad medium incisa, laciniis late rotundatis; stimulus longus; siphon ovatus; cotyledones mediocres; pecten plaga media scabra subtriangula, dentibusque 3 late truncatis; inter maxillipedes secundi paris dentes nulli. Ramus inferior pedum primi paris articulis 3,

\* *Loc. cit.*

quorum 2 ultimi brevissimi; flagella pedum verticula media prædita.—Long. circa 10, lat. 9 millim. (♀).

*Hab.* in America boreali (Connecticut, New Haven), in flumine Mill River, etiam ubi aqua marina æstu crescente aquæ dulci admiscetur. In cavitæte branchiali et in ipsis branchiis *Catostomi* sp. (*C. bostoniensis*, Lesueur, aut *communis*, ejusd.) inventus.

#### 7. *A. Nattereri*, Hell.

*SYN.* *Argulus Nattereri*, Heller, Sitzungsberichte d. Kais. Akad. d. Wissenschaft., Math.-Naturwissensch. Cl., (1857) xxv. p. 103, taf. 1. figg. 4–12; Kröyer, Naturhist. Tidskr. 3die Række, (1863) ii. pp. 97, 103, tab. 1. fig. 3 a–d.

Scutum cephalicum amplum, suborbiculatum, paullo latius quam longius, lobo frontali paullo prominenti, supra denticulis et setis scabrum, pedes omnes et basin caudæ tegens; cauda parum prominens, brevissima, longitudine circa  $\frac{1}{10}$  reliqui corporis, transverse elliptica, vix usque ad medium incisa; siphon magnus, subclavatus; cotyledones magni, diametro fere  $\frac{1}{2}$  longit. corporis æquantes; pectinis dentes 3 longi, subacuminati.—Longit. circa 12, lat. 13 millim. (♀).

*Hab.* in America meridionali (Brasilia): in branchiis et eute *Salmini* (*Hydrocyonis*) *brevidentis*, Cuv. (*Salmini Cuvieri*, Val.), inventus.

This well-marked species is fully described and figured both by Heller and Kröyer. The former has given special attention to the oral organs; and his description is more complete on this point than Kröyer's, which, however, is in other respects ampler and accompanied by better figures.

#### 8. *A. salmini*, Kr.\*

*SYN.* *Argulus salminei*, Kröyer, Naturhist. Tidskr. 3die Række, (1863) ii. pp. 89, 103, tab. 1. fig. 2 a–c.

Scutum cephalicum amplum, suborbiculatum, parum latius quam longius, lobo frontali lato, prominenti, pedes omnes, exceptis ultimi paris, tegens; cauda rotundata, paullo latior quam longior, fere ad tertiam longitudinis partem incisa, longit.  $\frac{1}{6}$ – $\frac{1}{7}$  reliqui corporis æquans; cotyledones magni, diametro circa  $\frac{1}{4}$  totius corporis longitudinis æquantes; pectinis dentes truncati, latiores quam longiores.—Long. circa 13, lat. 11 millim. (♀).

*Mas* differt magnitudine plus duplo minore, scuto cephalico elliptico, cauda paullo longiore quam latiore.

*Hab.* in America meridionali (Brasilia, Minas Geraës), in branchiis *Salmini* sp. inventus.

Of both this and the two following species Kröyer has given

\* Kröyer has *Salmineus*, *Argulus salminei*, which is probably a mistake.

exact and complete descriptions. It is only to be regretted that the oral organs have been neglected.

9. *A. chromidis*, Kr.

SYN. *Argulus chromidis*, Kröyer, Naturhist. Tidsskr. 3die Række, (1863) ii. pp. 92, 102, tab. 1. fig. 2 a-c.

Scutum cephalicum breve, ad segmentum trunci tertium tantum pertinens, fere inverse ovatum, parum longius quam latius, lobo frontali angustius rotundato; cauda subovata, longit.  $\frac{1}{3}$ — $\frac{1}{4}$  reliqui corporis, paullo longior quam latior, postice vix ad tertiam longitudinis partem excisa, laciniis apice subrotundatis; cotyledones mediocres, diametro circa  $\frac{1}{7}$  corporis longitudinis æquantes; dentes pectinis multo longiores quam latiores, medio acuto, lateralibus obtusis; ova non truncum tantum, sed totum fere scutum occupantia.—Longit. circa 6, latit. 4 millim. (♀).

Hab. in America centrali (Nicaragua), in branchiis *Chromidis* sp. ex lacu Nicaragua semel inventus.

10. *A. funduli*, Kr.

SYN. *Argulus funduli*, Kröyer, Naturhist. Tidsskr. 3die Række, (1863) ii. pp. 94, 103, tab. 2. fig. 1 a-e.

Scutum cephalicum parvum, longitudine circa dimidii corporis, paullo latius quam longius, antice angustatum, stipitem pedum primi paris saltem tegens, dorso postice gibbo; cauda longa, dimidiam reliqui corporis longitudinem fere æquans, duplo circiter longior quam latior, postice profunde, at non usque ad medium incisa, laciniis apice rotundatis; cotyledones magni, diametro circa  $\frac{1}{2}$  corporis longitudinis æquantes; art. primus maxillipedum secundi paris dentibus caret.—Long. circa 3, latit. versus 2 millim. (♂ ♀).

Hab. in America boreali (Louisiana, New Orleans), in cavitate branchiali *Funduli* sp. inventus.

11. *A. alosæ*, Gould.

SYN. *Argulus alosæ*, Gould, Report on the Invertebrata of Massachusetts, comprising the Mollusca, Crustacea, Annelida, and Radiata, (1841) p. 340.

Scutum cephalicum parvum, dimidio corpore paullo longius, inverse ovatum vel subcordatum, parum longius quam latius, stipitem pedum primi paris tegens; cauda longa,  $\frac{1}{3}$  reliqui corporis longitudine superans, circiter duplo longior quam latior, usque ad basin fissa, laciniis subacuminatis; cotyledones mediocres; truncus angustus, pedes longi.—Longit. circa 13, latit. 6 millim. (♀?)

Hab. in America boreali (Massachusetts), in branchiis *Alosæ* sp. (*A. tyranni* DeKay?) semel inventus.

This extremely short and meagre description is accompanied by a coarse woodcut representing the animal from beneath, but in which we can distinguish neither antennæ, "sting," nor shape of the mouth-tube. There seem to be no comb-like teeth on the hinder foot-jaws. The tail is described in the following words:—"Then [on the abdomen] follow two short folia, covered by two others, each of them nearly as long and as broad as the exposed part of the abdomen." The species undoubtedly stands near *A. funduli*, but seems to be distinguished by a somewhat longer head-shield, a longer and more deeply cloven tail, with more pointed lobes and smaller sucking-cups. Whether the feet possess flagella (*gissel*) or not, is not to be learnt from either description or figures.

This *Argulus* is, according to Gould, found on the "Alewife," which he identifies with the European *Alosa vulgaris*. Probably the fish in question was an *Alosa tyrannus*, Dekay, which, according to Valenciennes\*, is the Alewife of the United States.

In 'Silliman's Journal,' (1839) vol. xxxvi. p. 393, under the title "New Species of *Argulus*; notice from Dr. T. W. Harris," we find the following remarks:—"It may interest some of your readers to be informed of the discovery of another species of *Argulus* in this country. It was found in the gills of a herring caught upon Brighton Bridge, from Charles River, during the month of June last. It differs from *Argulus foliaceus* of Europe, and from the species described in a former number of your Journal, vol. xxxiv. p. 225†, in the size and form of the body and in the shortness of the legs. Having presented the specimen to Dr. A. A. Gould for description, I shall not attempt to anticipate him by giving a detailed account of its specific characters at this time."

It is undoubtedly *A. alosæ* which is here alluded to; for Gould says, with reference to this specimen, that it was presented to him by Dr. T. W. Harris, who found it on the branchiæ of the "Alewife," which fish in America, like the *Alosa vulgaris* with us, is often confounded under the general name of "herring" or "sill." Gould has described no other species of *Argulus*. That the species differs from *A. foliaceus* in the shortness of the legs, is a mistake. See the diagnosis.

## 12. *A. elongatus*, Hell.

SYN. *Argulus elongatus*, Heller, Sitzungsber. d. Kais. Akad. d. Wissensch., Math.-Naturwissensch. Cl., (1857) xxv. p. 106, taf. 3. figg. 1-4.

Scutum cephalicum minimum, longitudine trunci, inverse sub-

\* Cuvier et Valenciennes, 'Histoire Naturelle des Poissons,' (1847) tom. xx. p. 421.

† This probably means vol. xxxi. p. 297, where *A. catostomi*, Dana, is



cordatum, postice parum sinuatum, non excisum, neque truncum nec pedes tegens; cauda circa  $\frac{1}{5}$  longitudinis reliqui corporis æquans, profunde incisa, lobis sat longis, lanceolatis; cotyledones parvi; art. primus maxillipedum secundi paris dentibus caret.—Longit. 10 millim., latit. 6 millim. (♀).

*Hab.* in America meridionali (Brasilia). Hospitium ignotum.

Amongst all known species of Argulids this one has the head-shield least developed, and its appearance is therefore very different from that of the others. Heller's description is very brief, and leaves undetermined, as does also his figure, whether the animal has a sting (*gadd*), and whether its feet are provided with flagella or not.

*Obs.* *Argulus armiger*, Müll. (Entomostraca, p. 124) = *Monoculus armiger*, Slabber\*, is no *Argulus*, but the larva of a Cirripede.

## II. GYROPELTIS, Heller.

### 1. *G. longicauda*, Hell.

SYN. *Gyropeltis longicauda*, Heller, Sitzungsberichte d. Kais. Akad. d. Wissensch., Math.-Naturwissensch. Cl., (1857) xxv. p. 191, taf. 1. figg. 1-19; Kröyer, Naturhist. Tidsskr. 3die Række, (1863) ii. pp. 99, 103, tab. i. fig. 4 a-e.

Scutum cephalicum suborbiculare, amplum, omnes pedes tegens; cauda longissima,  $1\frac{1}{2}$ -2-plo longior et duplo angustior quam scutum et reliquum corpus, fere usque ad basin in duas lacinias angustas, sensim lanceolato-acuminatas fissa; pectinis dentes 3 conici, acuti.—Longit. 28, latit. 11 millim. (♂ ♀).

*Hab.* in America meridionali (Brasilia), in branchiis *Salmini brevidentis* (Cuv.) inventus.

### 2. *G. doradis*, Corn.

SYN. *Gyropeltis doradis*, Cornalia, Mem. del R. Istit. Lombardo, (1860) viii. pp. 161, tab. 2. figg. 1-18.

Scutum cephalicum suborbiculare, pedes ultimi paris vix tegens; cauda sat longior, reliqui corporis dimidiam longitudinem circiter æquans, fere usque ad basin in duas lacinias angustas, sublancoatas fissa; pectinis dentes 3 breves, acuti.—Longit. 22, latit. 11 millim. (♀).

*Hab.* in America æquinoctiali, in corpore *Doradis nigri* Valenc. inventus.

described. That described in vol. xxxiv. p. 225 is a *Caligus* (*C. americanus*, Pickering & Dana), not an *Argulus*.

\* Naturkundige Verlustigungen, behelzende microscopische waarnemingen, &c. (1769), cited from P. L. St. Müller's German translation: Physikalische Belustigungen, &c. (1775) p. 19, tab. 6. fig. 1.

3. *G. Kollari*, Hell.

SYN. *Gyropeltis Kollari*, Heller, Sitzungsberichte d. Kais. Akad. d. Wissensch., Math.-Naturwissensch. Cl., (1857) xxv. p. 102, taf. 1. figg. 20, 21; taf. 2. figg. 1-3.

Scutum cephalicum inverse subcordatum, amplum, omnes pedes et basin caudæ tegens; cauda brevis,  $\frac{1}{3}$ - $\frac{1}{4}$  reliqui corporis longitudinis æquans, inverse rotundato-ovata, postice parum profunde incisa, laciniis brevibus obtusis; pectinis dentes 3 breves, obtusi.—Longit. 12, latit. 9 millim. (♀).

Hab. in America meridionali (Brasilia). Hospitium ignotum.

?4. *G. Lacordairei* (Aud.).

SYN. *Dolops Lacordairei*, Audouin, Annales de la Soc. Entomol. de France, sér. 1. t. vi. (1837), Bull. p. 13.

Long. plus 15 millim.

Hab. in America meridionali (Cayenne), in pisce *Aymara* dicto parasitans.

Concerning this animal we have the following remarks from the above-cited source:—

“M. Audouin présente deux individus d’un crustacé singulier, qui a beaucoup d’analogie avec l’Argule foliacé de Jurine, mais qui en diffère surtout par l’absence de ventouses aux pattes antérieures, et par sa taille, qui dépasse un centimètre et demi.

“Ce crustacé a été trouvé à Cayenne par M. Lacordaire; il est parasite sur un poisson nommé *Aymara*, dont la chair est très-estimée, et qui vit dans toutes les rivières. M. Audouin en donne la description et le regarde comme le type d’un nouveau genre, auquel il assigne le nom de *Dolops*. Il dédie cette espèce à M. Lacordaire:

“*Dolops Lacordairei*. Ce nouveau genre sera décrit en détail et figuré.”

That this *Dolops Lacordairei* is a *Gyropeltis*, or at least stands very near this genus, may be regarded as certain. But although the name *Dolops* is older than *Gyropeltis*, it seems to me in every respect more desirable to retain the latter appellation, inasmuch as Audouin did not determine or clearly point out the characters on which he founds the genus *Dolops*. No description of the species has, as far as I can discover, been published.

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As at the most sixteen species of the family Argulidæ are as yet known, and as this number will undoubtedly be considerably increased, it would be premature now to attempt to draw, from what is known of the localities of these species, any general conclusions as to the geographical range of the family. We may, however, suppose with Krøyer that the great American continent

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is its proper habitat, since *three-fourths* of the species which belong to the genus *Argulus*, together with all the species of the genus *Gyropeltis*, are limited thereto. The greater number belong to the warm parts of that continent: only one species (*A. pugettensis*) is known from the west coast of (North) America. Of the four non-American species enumerated in our list, *Europe* has afforded *three*, and *Africa* *one* species (inhabiting the Mediterranean).

It is further of importance to note the relative numbers of the species which live in *fresh* and in *salt* water. We perceive at once that, *as in the other Branchiopoda*, the number of *freshwater forms* preponderates. If we except the four species (*A. pugettensis*, *funduli*, and *elongatus*, with *Gyropeltis Kollari*) concerning which information in this respect is wanting, it will be seen that of the remaining species only *two* (*A. purpureus* and *giganteus*) are found on fishes which live exclusively in the sea; all the others are procured from fresh water. It would be of great importance to learn whether or not some of these freshwater forms can also live in salt water, and, in particular, whether the species (*A. coregoni* and *alosa*, for instance) which live on fishes which undertake journeys from the sea up the rivers follow their hosts when these betake themselves again to the sea. We have already stated that *A. catostomi* lives also in the brackish water near the mouths of rivers.

In close connexion with the consideration that the larger number of the Argulidæ belong to lakes and rivers, and only a small portion to the sea, is the result which we obtain from an inquiry how they are distributed amongst the various groups of fishes. That the Argulids are not always (perhaps never) confined to a single sort of fish is shown in the case of the three European species, which live on fishes of different genera, even of widely separated families—especially *A. foliaceus*, the only Argulid of whose habitat and mode of life we have a tolerably satisfactory knowledge. This species not only attaches itself to freshwater fish of wholly different orders (Acanthopteri, Pharyngognathi, and Physostomi), but even attacks the larvæ of *frogs*, which is not known to be the case with any of the other species. We are ignorant as to the animals on which three of these (*A. pugettensis*, *A. elongatus*, and *G. Kollari*) occur. The rest have all been found on fishes, and, with the exception of a single species, on Teleostei or bony fishes. Of the other subclasses only one (*viz.* the *Selachia*) has figured in our list. *A. giganteus* is found upon a *Ray*. Amongst bony fishes it is, as we might almost conclude *à priori*, especially the order Physostomi which is affected by these parasites. A species of the Siluroid family harbours *G. doradis*; many Cyprinoids

are attacked by *A. foliaceus*, one by *A. catostomi*. Cyprinodonts have afforded *A. funduli*; the Characinidæ *A. Nattereri*, *A. salmini* and *G. longicauda*. Salmonoids are affected by *A. coregoni* and *A. foliaceus*, which has also been taken on an Esocoid; the Clupeidæ finally have contributed a species, *A. alosæ*. Among the Pharyngognathi the family Chromidæ has a parasite in *A. chromidis*; and among the Acanthopteri it is the families Scombridæ (for *A. purpureus* and *foliaceus*), Sparidæ (for *A. purpureus*), and Percidæ (for *A. foliaceus*) on which representatives of the Arguloid family have been hitherto observed.

I avail myself of this occasion to refute some objections which have lately been put forward by Claus\* against the attempted arrangement of the order Copepoda communicated by me in my memoir above cited—"Contribution to our knowledge of the Crustacea which live on the species of the genus *Ascidia*, L."† This arrangement (in three parallel series, Gnathostoma, Pœcilstoma, and Siphonostoma) is based upon the structure of the organs of the mouth, which, he says "in the first division are adapted for chewing, in the other two for piercing and sucking. The arrangement of the free and parasitic in parallel series renders the formation of the subordinate groups more difficult, the three forms of mouth presenting numerous cases of transition. It separates nearly allied forms, and, if strictly adhered to, produces an unnatural and one-sided system. Further, the character imputed to the Pœcilstoma—"Os mandibulis et siphone carens, maxillarum paribus 3-1(-0) instructum"—rests on an error, since the mandibles are very well developed."

To begin with the last remark, which seems to contain a charge of especial weight, since it would appear that Claus represents me as overlooking in the Pœcilstoma the presence of the very organs (the mandibles) on the presence or absence of which the differences between the Gnathostoma and Pœcilstoma depend. That such, however, is not his meaning, is apparent from an expression on p. 28, where we read, "Here [in the Corycæidæ] the maxillæ are reduced to very simple plates furnished with several bristles, and have been regarded by Thorell as appendages of the mandibles." In effect the differences between Claus's and my notions of the oral organs of the Pœcilstoma reduce themselves

\* Die frei lebenden Copepoden, p. 9.

† Prof. Krøyer (Bidrag til Kundskab om Snyltekrebsene, p. 82) also, but more summarily, attacks this attempt. As, however, he brings forward no sufficient objection, either against the principle adopted or the mode of its application, but rather confines himself to bitter invectives against those zoologists who, not troubling themselves with "mere descriptive work," are yet bold enough to "put forward systems," I shall treat his criticisms as they deserve.

to the circumstance that what he calls mandibles I regard as maxillæ, and his maxillæ are, according to my view, the appendages of the maxillæ, maxillary palpi. The reasons on which I base my view are the following:—First and foremost, the organs in question are sometimes *fused together*, as in the genera *Corycaeus* and *Lichomolgus*; and it is more especially apparent in the last genus that the posterior ones are nothing more than appendages of the anterior ones, from the fact that they are not directed towards the opening of the mouth, but have their free border turned *backwards*. Now, since I know of no example in the Copepoda of the maxillæ taking the form of mandibular appendages, but several (among the parasitic forms) in which the palp separates itself from its union with mandible or maxilla, I have thought this sufficient reason for the supposition that the organs mentioned belong to the *same* pair. That I explain them as *maxillæ*, and consequently regard the mandibles as wanting, not the opposite, depends partly on the fact that they are situated further backwards than the mandibles of the Gnathostoma, partly and principally on the circumstance that I have found in two species of the genus *Lichomolgus*, precisely in the position occupied in the Siphonostoma by the proboscis with its enclosed mandibles, a half-rostrum, which I conceive should be regarded as a *rudimentary sucking-tube*. Were Claus's view correct, it would follow that "the mandibles" in the Copepoda in question must always want the mandibular palpi, and the "maxillæ" similarly always be without maxillary palpi. On the other hand, there is no lack of instances among the lower Crustacea of the absence of the mandibles. Among the Ostracoda the mandible is represented in *Cypridina* by an appendage on the maxilla, and is altogether wanting in *Philomedes*. In the Copepoda I will only recall (to say nothing of the parasitic forms) the genera *Sapphirinella*, Claus, which for oral organs possesses only a pair of maxillary feet, and *Monstrilla*, Dana, which wants *all* the oral appendages.

I have not been able to find, either among the forms known to me from autopsy or representations, any instance of actual *transition* between the oral organs of the Gnathostoma and Pœcilostoma. Certainly, in the genera *Candace*, Dana, and *Hemicalanus*, Claus, the mandibles, in their longer and slenderer shape, and in offering only two teeth at the extremity, differ not a little from the usual form of the mandibles in the Gnathostomous series; and it is probable that they are used more as piercing- than as chewing-organs. But the presence of a strong two-branched *maxillary palp*, besides separate many-lobed maxillæ of the usual nature, shows at once that this genus cannot be referred to the Pœcilostoma, but is essentially Gnathostomous.

Neither am I acquainted with any transition between the Pœcilstoma and Siphonostoma. It is freely granted that, in such forms as lack the appendages of the mouth, it may be sometimes difficult to determine to which series they should be referred; but in such instances correspondences in other parts of the general structure must decide the question: for example, it is easy to see that *Monstrilla* is a Pœcilstome and approaches the Corycæidæ, to which family it is, indeed, referred by Claus.

From what has now been said, it follows that I cannot admit that my arrangement of the Copepoda renders difficult the formation of subordinate groups, families, and genera. On the other hand, it is conceded that it sometimes removes from each other forms which in habitus stand tolerably near together; but this inconvenience is in a great measure compensated by the *parallelism* of the series. Certain it is that by the division of the Copepoda into *Copepoda carcinoidea* and *C. parasitica*, adopted by Claus, this inconvenience is not avoided: any definite limitation of these two groups based upon characters drawn from the form is not to be thought of. Claus himself admits this, but consoles himself with the consideration that the impossibility of a sharp definition of limits lies in the very nature of any system which would be true to nature. Many, however, will be found who will agree with me in not resting content with such reasoning, but in regarding fixed principles for the forming of divisions as necessary for any systematic arrangement. And if the source of such division be sought in the modifications of organs which are constant in their nature and significance throughout the entire life of the animal, which has seemed to me to be the case with the oral organs, a sharp definition of the limits of groups will not necessarily make the system one-sided and unnatural.

[*Note.* In a rather lengthy footnote appended to the preceding paper, Prof. Thorell makes the following important remarks relative to the nomenclature of the various portions of the body in the Argulids. Reverting to p. 150, we find that Prof. Thorell applies the terms *head* or *head-shield*, *trunk*, and *tail* to the principal divisions of the body in Argulids, calling the pieces attached posteriorly to the latter *appendages*, not *postabdomen*. In connexion with this he says:—

“Such a terminology differs somewhat from the now generally received division of the Crustacean body into *head*, *thorax*, *abdomen*, and *postabdomen*. There are several objections to this division. *Thorax* and *abdomen* are divisions founded (throughout the greater portion of the Articulate series) on notions almost exclusively drawn from the class of Insects, and are not properly applicable to any but that class and the Arachnids, where they

correspond to distinct sections of the bodily functions. This is not the case in either Myriopods or Crustaceans, where, however, the *head* is distinctly separated from the *trunk*; and, in Crustaceans at least (as in the Scorpions), the hindmost segment of the trunk is usually distinct, both in form and function, from the others, thus forming a *tail* or postabdomen so called. With the first three segments of the trunk, corresponding to the thorax of insects, this, however, is by no means the case; consequently the term 'thorax' seems quite inapplicable, since there is really no definite division of the body to apply it to; and with the rejection of the appellation 'thorax,' the terms 'abdomen' and 'postabdomen' also must necessarily be laid aside.

"The anterior segments of the trunk, on the contrary, show here, as in the Myriopods, a strong tendency to coalesce with the genuine head, and their extremities are thus most generally metamorphosed into organs used for chewing or holding food, i. e. *foot-jaws*. Either it is only *one* such segment which thus loses its own independent character, and becomes tributary to the head (Edriophthalma), or it is *two*, unless both pairs of foot-jaws belong to the same segment, as in Copepoda and Argulidæ, or *all three* of the so-called thoracic segments (Decapoda). Sometimes these segments, with their appendages, become more or less rudimentary, or would seem to disappear altogether, as in the Branchiopoda. (In the Squillidæ all the first five segments of the trunk are subordinate to the head.) In all these cases it seems better to call any anterior division of the body, however formed by such fusion of one, two, or three posterior segments, *head*. In the Decapoda, where three segments are united with the head, the term *cephalothorax* is perhaps a suitable one, if not that of *cephalocormus*, which I would apply to designate the complete fusion of the whole trunk with the head as a single piece. There is, however, even better reason for using 'cephalothorax' in connexion with the Argulids and many of the parasitic Copepods, as the *Caligidæ*, where the extremities or "foot-jaws" which have become coalescent with the head are not accessory oral organs, but genuine fixing- or seizing-organs. It should, however, be observed that every possible transition is found between such fixing-organs and the ordinary foot-jaws, and that only *one*, or at most two, segments of the trunk can be regarded as entering into the composition of any such cephalothorax.

"Often, indeed, amongst the Copepoda one of the trunk-segments is united with the head and the foregoing ones; but in this case the extremities of the segment are always of the same form as those of the preceding trunk-segments, i. e. *swimming-feet*, not foot-jaws, and such a segment belongs consequently to

the same division of the body as those preceding it. It may even be taken as a rule that all the *lower* Crustaceans (Xiphura, Branchiopoda, Ostracoda, Copepoda, and Cirripedia) have typically *two* pairs of foot-jaws, never more, while the Malacostraca have either *three* pairs or only *one* pair,—and, further, that the former have only *one* pair of maxillæ, while the Decapoda and other Malacostraca have generally *two* pairs.

“Thus in order to obtain at the same time a uniform and practically useful terminology for the class Crustacea, it seems to me advisable to abolish in that group the utterly meaningless divisions *thorax* and *abdomen*, and to adopt those which I have now put forward, viz. *head*, *trunk*, and *tail*.”]

LVII.—*A List of Spiders captured in the South-east Region of Equatorial Africa; with Descriptions of such Species as appear to be new to Arachnologists.* By JOHN BLACKWALL, F.L.S.

MY friend Mr. Meade having transmitted to me for examination a second collection of spiders, made in the south-east region of equatorial Africa by the late Mr. Richard Thornton and Mr. Horace Waller, the result of my investigation of the specimens contained in it is given in the following list.

Tribe Octonoculina.

Family LYCOSIDÆ.

Genus CTENUS, Walck.

*Ctenus vagus*, n. sp.

Length of the female  $1\frac{1}{4}$  inch; length of the cephalothorax  $\frac{2}{3}$ , breadth  $\frac{1}{2}$ ; breadth of the abdomen  $\frac{2}{5}$ ; length of an anterior leg  $2\frac{1}{6}$ ; length of a leg of the third pair  $1\frac{1}{2}$ .

The eyes are disposed on the anterior part of the cephalothorax in three transverse rows; the two anterior ones, with the two intermediate ones of the four constituting the second row, describe a trapezoid whose shortest side is before; and each of the two eyes forming the posterior row; with a lateral one of the second row, is seated on a tubercle; the intermediate eyes of the second row are the largest, and the lateral ones, which are in a line with them, much the smallest of the eight. The cephalothorax is compressed before, truncated in front, rounded on the sides, which are depressed and marked with furrows converging towards a narrow indentation in the medial line of the posterior region; it is clothed with short brownish-yellow hairs, and is of a dark reddish-brown colour, with narrow, brown lateral margins. The falcæ are powerful, conical, vertical, and